

INDIAN DRAGONFLIES.

BY

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(With 4 Text figures.)

(Continued from page 691 of Volume XXVII.)

Family—AESCHNIDÆ.

PART XI.

Insects usually of large size, with long and cylindrical abdomen. Eyes markedly or only slightly contiguous or more or less widely separated; ocelli arranged transversely in front of vesicle; labium with the middle lobe not markedly smaller than or overlapped by the lateral lobes, the latter not furnished with a moveable hook; antenodal nervures of 1st and 2nd series not coinciding save for occasional individuals; trigones more or less similar in all wings and situated equally distal to the arc; anal appendages specialized; a well developed ovipositor present in the females.

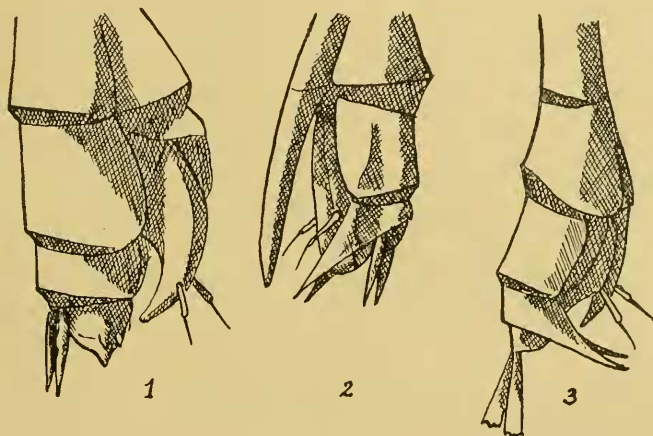


Fig.—1. Abdominal endings of females of 1. *Cephalæschna*, 2. *Gynacantha*, 3. *Gynacantha* (anal appendages shown broken off).

Subfamily 1.—AESCHNINÆ.

Insects of large size, with long and cylindrical abdomen. Head large and globular; eyes markedly contiguous, which is the first essential character separating them from the following subfamily *Gomphina*. Generally speaking, *Anax* and *Gynacantha* have very large eyes which are contiguous for a long distance, whilst they are smaller and less contiguous in the *Aeschina*.

Wings long and broad, reticulation usually close, trigones elongated in the long axis of the wing and closely similar in shape in all wings. In the group *Anax* the wings are similar in the two sexes, the males of all other groups and genera have the anal borders excavated or straight and the anal angle prominent but less so in *Anacischna*. The anal border has a large triangle divided

into two or more cells and defined by a straight nervure which leaves the subcostal nervure and forms the acute point of the triangle by meeting the anal border near the anal angle (or tomus). In the group *Anax* the similarity between the two sexes is very marked, the anal triangle disappearing in both completely.

Oreillets more or less developed or in the group *Anax*, entirely absent. The connection between these organs and the excavation of the hindwings has already been commented on in dealing with *Hemicordulia asiatica*.

The basal space (for which I propose the new name "arcular space" as it is limited outwardly by the arc) is either entire or traversed by several nervures. The 4th nervure (nodal sector) either curved uniformly or making an abrupt curve towards the costa beneath the stigma; the 5th nervure (Rs or subnodal sector) either bifurcated or not, at or before the inner end of the stigma.

♀ The terminal border of the 10th abdominal segment beneath (known as the "dentigerous plate") most generally rounded and most often denticulate, but in *Gynacantha*, *Gynacanthæschna* and *Periæschna* it is prolonged into a long, bifurcated fork.

Hab.—Cosmopolitan.

It is impossible to give an entirely satisfactory key for this subfamily owing to the paucity of our knowledge of several forms of which only one or the other sex is at present known. This applies especially to the imperfectly known genera *Cali*—and *Cephalæschna*.

Dr. Laidlaw in the Records of the Indian Museum has pointed out the errors which have crept into the nomenclature of the species of these two genera and these may be usefully recapitulated here.

The genus *Caliæschna* was founded by Selys in 1883 *Æschna microstigma*, Schneider, being the type. The rounded, subdenticulate, dentigerous plate which is a characteristic of the female of this species was unknown to Selys when he founded the related genus *Cephalæschna* from *C. orbifrons* in 1885 and he gave the same character as of generic value to this genus.

Noticing that Selys had overlooked the character of the dentigerous plate in *Caliæschna microstigma*, Martin, in 1909, made the error of suppressing the genus *Cephalæschna* and of placing *C. orbifrons* in the genus *Caliæschna* without taking into account the diversity of the two species in other respects. A distinguishing feature is the remarkable development of the frons in *Cephalæschna orbifrons* as compared with the normal development found in *Caliæschna microstigma*.

Karsch in 1891 taking the development of the frons as the most important feature described *Cephalæschna sikkima*. In this species the dentigerous plate of the female is forked very much the same as is found in species belonging to the genus *Gynacantha* so that it clearly cannot be placed in the genus *Cephalæschna* and for a similar reason it falls outside the range of *Caliæschna*.

Thus it is seen that *Cephalæschna* must be retained and a new genus must be erected to contain Karsch's species, and others resembling it.

The three genera may be briefly defined as follows:—

1. **Caliæschna** with the dentigerous plate of the female rounded and subdenticulate and the frons of normal development.
Type—*C. microstigma*, Schneid.
2. **Cephalæschna** with the dentigerous plate of the female rounded and subdenticulate and the frons remarkably developed.—
Type—*C. orbifrons*, Selys.
3. **Gynacanthæschna** *gen. nov.* with the dentigerous plate of the female forked and the frons remarkably developed.
Type.—*C. sikkima*, Karsch.

Dr. Tillyard merges the genus *Hemianax* with *Anax* but I prefer to keep them separate, as in addition to the absence of the supplementary ridges to abdomen, there are other generic characters.

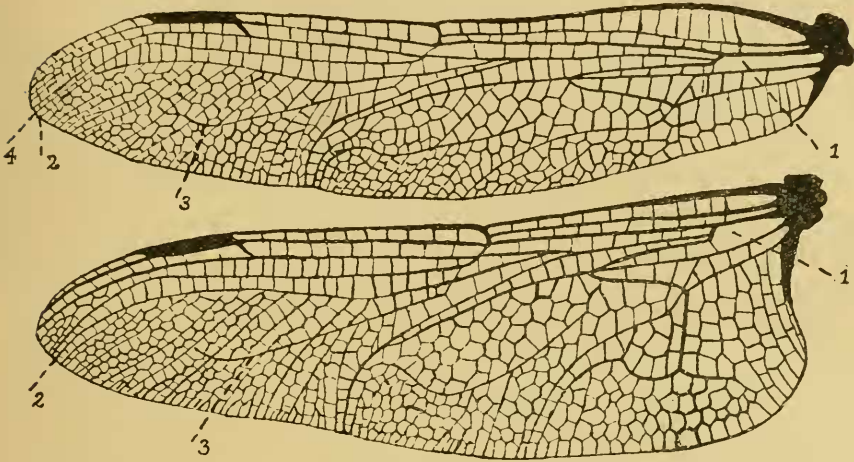


Fig. 2.—Wings of *Anax parthenope parthenope*, male.

1. Arcular or basal space, 2. 5th nervure (Rs), 3. 5a nervure (Rspl),
4. 4th nervure (M2 or nodal sector).

Key to the Sub-family—ÆSCHNINÆ.

- | | | | |
|---|---|--|------------------------------|
| 1 | { | Anal border of hindwing rounded in both sexes; 5th nervure (Rs) not bifurcated; 4th nervure (M2 or nodal sector) with an abrupt convexity forwards at outer end of stigma; sectors of arc arising from above the middle of arc | 2 |
| | | Anal border of the hindwing rounded in the female only; 5th nervure bifurcated (except in <i>Jagoria</i>); 4th nervure uniformly curved as far as termen; sectors of arc arising from or below the middle of arc | 7 |
| 2 | { | Genus <i>Hemianax</i> :— | |
| | | Only a single, lateral bordering ridge to segments 4 to 8, no supplementary ridge above it | <i>Hemianax ephippiger</i> . |
| 3 | { | Genus <i>Anax</i> :— | |
| | | Lateral, supplementary, parallel ridges to segments 4 to 6 | 3 |
| 3 | { | The thorax laterally, sky-blue marked with an anterior, narrow and a median, broad, black stripe | <i>Anax immaculifrons</i> . |
| | | The thorax laterally green or pale brown, unmarked | 4 |
| 4 | { | Inferior anal appendages half the length of the superior | <i>Anax guttatus</i> . |
| | | Inferior anal appendages considerable less than half the length of the superior | 5 |

5	{	Inferior anal appendages one-third the length of the superior ; a black, T-shaped mark on upper surface of forehead	<i>Anax parthenope bacchus.</i>	6		
		Inferior anal appendages only one-fourth the length of the superior ; no black, T-shaped mark on upper surface of forehead				
6	{	Crest of forehead with a transverse, brown stripe bordered posteriorly with yellow ; membrane white	<i>Anax parthenope parthenope.</i>	6		
		Crest of forehead with a brown, transverse stripe bordered posteriorly with blue ; membrane black, white at base			<i>Anax parthenope julius.</i>	
7	{	Basal space traversed by several nervures	8	13		
		Basal space entire				
8	{	Dentigerous plate of female rounded and subdenticulate	9	12		
		Dentigerous plate of female forked				
9	{	Genus <i>Calieschna</i> (Persian species) :—		10		
		Frons only normally developed	<i>Calieschna microstigma.</i>			
		Genus <i>Cephaloeschna</i> :—				
10	{	Frons remarkably developed	10	11		
		Frons projecting markedly, like the bows of a ship ; frons and face yellow without markings			<i>Cephaelschna acutifrons.</i>	
		Frons projecting markedly in a rounded, globular form, pale brown ; face yellow above, black below with two small yellow spots on the labrum			<i>Cephaloeschna orbifrons.</i>	
11	{	Frons yellow bordered with black above	11	14		
		Frons shiny black in front			<i>Cephaloeschna lugubris.</i>	
12	{	Frons yellow in front	14	15		
		Frons yellow in front			<i>Cephaloeschna masoni.</i>	
12	{	Genus <i>Periceschna</i> :—		15		
		Trigones of forewings long, of 5 to 6 cells ; thorax dark brown marked with bright yellow stripes	<i>Periceschna magdalenz.</i>			
		Genus <i>Gynacanthoeschna</i> :—				
13	{	Trigones of forewings shorter, of 3 to 4 cells only ; thorax brown or black marked with green stripes	15	14		
		Genus <i>Jagoria</i> :—				
14	{	5th nervure (Rs) unforked	<i>Jagoria martin</i>	14		
		5th nervure forked				
14	{	Genus <i>Austroeschna</i> :—		15		
		Only 1 row of cells between nervures 5 and 5a (Rs and Rspl)	<i>Austroeschna intersedens.</i>			
		3 to 7 rows of cells between nervures 5 and 5a	15			

15	Genus <i>Anacischna</i> t— Base of hindwing sub-rounded; 4th nervure making an abrupt curve towards the costa, beneath the stigma as in <i>Anax</i>	<i>Anacischna jaspidea.</i>	
		Base of hindwing in the male more or less angulated and excavated	16
16	Genus <i>Æschna</i> t— Dentigerous plate in the female rounded and denticulate or subdenticulate or elongate	17	
		Genus <i>Gymacantha</i> :— Dentigerous plate in the female prolonged as a two-pronged fork	22
17	Dentigerous plate in the female elongate and spout-like, the hinder border furnished with a number of long teeth	18	
		Dentigerous plate in the female rounded and subdenticulate	19
18	Superior anal appendages narrow but broadening widely at the apex and expanded abruptly into a hawk's-bill-like process inferiorly; a robust spine on the dorsum of the 10th abdominal segment	<i>Æschna ornithocephala.</i>	
		Superior anal appendages broad and spatulate; only a poorly-developed spine on the dorsum of the 10th abdominal segment	<i>Æschna erythromelas.</i>
19	Antehumeral bands on thorax green	20	
		Antehumeral bands on thorax bright yellow	21
20	Sides of thorax entirely green; a small spine on the dorsum of the 10th abdominal segment; appendages narrow and tapering	<i>Æschna viridis.</i>	
		Sides of thorax with 2 broad, yellow stripes; no spine on the dorsum of 10th abdominal segment; superior anal appendages very broad and leaf-like	<i>Æschna petalura.</i>
21	Very large insects with a total length of about 74 mm.; a sharp, robust and prominent spine on the dorsum of the 10th abdominal segment	<i>Æschna juncea.</i>	
		Smaller insects with a total length of about 64 mm.; only a poorly developed, depressed spine on the dorsum of 10th abdominal segment	<i>Æschna mixta.</i>
22	Inferior anal appendages more than half the length of the superiors	<i>Gymacantha khasiaca.</i>	
		Inferior anal appendages less than one-third the length of the superiors, usually one-fourth or one-fifth	23
		Inferior anal appendages more than one-third but less than one-half the length of the superiors	24

- 23 { Superior anal appendages with the basal three-fourths slender, the apical fourth dilated and spatulate-like, the apex slightly rounded *Gynacantha basiguttata.*
 Superior anal appendages with the basal and apical thirds dilated, the middle third a little constricted, the apex pointed *Gynacantha subinterrupta.*
- 24 { Abdomen not constricted at the third segment, unmarked save for some green on the first two segments; frons without any markings on its upper surface *Gynacantha millardi.*
 Abdomen with at least some slight constriction of the third segment, marked with yellow, green or blue markings on most segments; frons with a blackish T-shaped mark or an anterior bordering of the same colour on its upper surface 25
- 25 { Superior anal appendages seen from above, markedly sinuous; abdomen only slightly constricted at the 3rd segment; legs reddish. *Gynacantha furcata.*
 Superior anal appendages seen from above, more or less straight; 3rd abdominal segment variable; legs yellow or brown 26
- 26 { Length of hindwing not more than 35 mm.; abdomen not more than 42 mm. in length; abdomen reddish brown spotted with green; 3rd abdominal segment very constricted *Gynacantha sallatrix.*
 Length of hindwing not less than 40 mm.; abdomen not less than 45 mm., and usually more than this.. .. . 27
- 27 { Upper surface of frons with its anterior border blackish brown; antenodal nervures to forewing 18 to 21; 3rd abdominal segment slightly constricted *Gynacantha bayadera.*
 Upper surface of frons with a blackish-brown T-shaped like mark; antenodal nervures to forewing 24 to 34; 3rd abdominal segment markedly constricted 28
- 28 { Abdomen blackish brown above, reddish beneath, no markings *Gynacantha hyalina.*
 Abdomen black and grey, marked with blue spots 29
- 29 { Abdomen and hindwing of approximately the same length (about 44 mm.); blue markings on segments 3 to 7 rather obscure *Gynacantha hanumana.*
 Abdomen longer than the hindwing (50 mm. compared to 47 mm or less; blue marks on segments 3 to 7 well defined *Gynacantha bainbriggeri.*

Group—ANAX.

Eyes very large, globular and broadly contiguous; occiput rather small. Wings long and broad, reticulation close, the base of hindwings in both sexes rounded and not excavated; 4th nervure (M2 or nodal sector) making an abrupt

curve towards the costa near outer end of stigma; 5th nervure (Rs or subnodal sector) not forked; stigma long and slender; arcular space entire; membrane long and broad; trigones very elongated, of 4 to 8 cells; border of 10th abdominal segment in the female subrounded and subdenticulate; anal appendages entire, variable but more or less lanceolate in shape; abdomen with or without lateral, accessory, longitudinal ridges on segments 4 to 8.

Only two genera—*Anax* and *Hemianax*.

Genus—ANAX, LEACH.

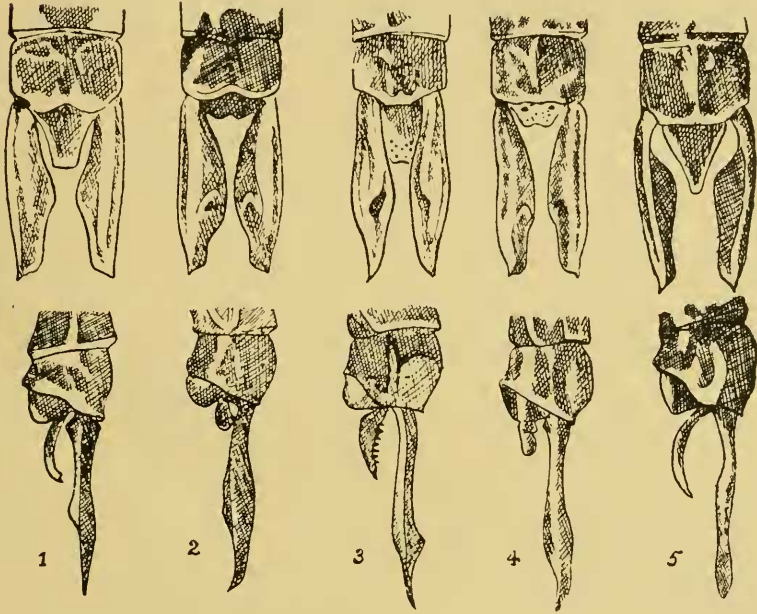


Fig. 3.—Dorsal and lateral aspects of the anal appendages of 1. *Anax guttatus*, 2. *Anax parthenope julius*, 3. *Hemianax ephippiger*, 4. *Anax parthenope parthenope*, 5. *Anax immaculifrons*.

ANAX, Leach, Edinb. Encycl. ix, p. 137 (1815).

Eschna, Van der Lind.

Cyrtosoma, Burm. Handb. Ent. ii, p. 839 (1839); Charp. Lib. Eur. p. 13 (1840).

Anax, Ramb. Ins. Nevv. p. 182 (1842); Brauer, Reise d Novara. Neur. p. 59 (1856); Steph. III. Brit. Ent. Mand. vi, p. 81 (1836); Selys, Mon. Lib. Eur. p. 113 (1840); id., Rev. Odon. p. 109 (1850); id., Bull. Acad. Belg. (3) v., p. 723 (1883).

Lateral supplementary ridges on abdominal segments 4 to 8; anal superior appendages thick, sublanceolate, hollowed inwardly, with a keel or ridge above, the inferior quadrilateral.

Type. *Anax formosus*, Van der Lind.

1. **Anax immacuifrons**, Ramb. Ins. Neur., p. 189 (1842); Brauer, Reise d Novara, Neur, p. 60 (1866); Kirby, Cat. Odon., p. 84 (1890); Martin, Cat. Coll. Selys, Aeschnines, xix, xx, p. 18, fig. 12 (1909); id., Bull. Soc. Ent. Frn. xii, p. 212 (1909); Ris, Suppl. Ent. No. v, pp. 63-65 (1916); Laid. Rec. Ind., Mus. MS (1921).

Male Abdomen 59 mm., Hindwing 57 mm.

Female Abdomen 57 mm., Hindwing 58 mm.

Male—Head large and globular; eyes a beautiful sea-blue during life, broadly contiguous; labium, labrum, epistome, frons and vesicle all pale bluish green, unmarked; occiput green or bluish green.

Prothorax brown, completely hidden by the overhanging head.

Thorax bulky, matt green on front and dorsum, bright, glossy sky-blue on the sides, which are marked with two jet black stripes, an anterior narrow and a median, oblique broad, both somewhat sinuous. The tergum spotted with blue in the form of a cross.

Wings hyaline, more commonly enfumed and often tinted with yellow for a great part of their area, membrane large, black with a large, basal, white spot; reticulation close, black but many of the nervures at the base of wing, including the lower half of arc and the antenodal nervures of the 2nd series pale yellow; costa yellow; antenodal nervures to the forewing 19 to 21, postnodals 10 to 12, antenodal nervures to hindwing 15, postnodals 12 to 14; trigones in forewing with 6 cells, in hindwing 5; 5 cubital nervures in the forewing, 4 in the hind; 4 to 5 rows of cells between 5 and 5a; stigma broad, narrow and long, dark brown above, paler beneath.

Abdomen tumid at the base, a little constricted at base of 3rd segment, cylindrical and of even width afterwards as far as the anal end. First segment black, 2nd and 3rd sky-blue on the dorsum and sides, the former with a broad, transverse, subbasal, black band broadest on the dorsum and an apical, black ring which extends squarely basalwards along the dorsum but is not usually confluent with the subbasal mark; remaining segments a dirty pale blue or pale yellow with the apical halves or more, black and a small, triangular, dorsal black mark on the paler area which is the analogue of the larger marking seen on the 2nd segment; on the 8th segment, the apical black more extensive and on 9 and 10 the black covers the whole of dorsum, the sides and the apical border of the 10th segment yellowish.

Legs black, robust, long. On the outer side of the hind femora at the distal end, a robust, bifid spur is seen which is less marked on the other femora.

Anal superior appendages brown; seen from above they are narrow at the base, then broadening rather abruptly and widely on the inner side and tapering again gradually to the apex which is rather obtuse, bevelled outwardly to a fine point. A prominent keel runs the length of the upper surface along the outer border. Inferior appendages barely half the length of the superior, broadly triangular and strongly curved in profile. (Fig. 3, V).

Female.—Head: labium, labrum, epistome and frons pale yellowish green and unmarked save for a narrow black bordering to the lips; eyes pale bluish green, greenish yellow below; occiput pale olivaceous.

Thorax sap green on the dorsum, pale greenish yellow on the sides which are marked with a narrow, sinuous, black, posthumeral stripe and a broad, pale brown or darker brown, median stripe which is bordered narrowly in front and behind with black. The metepimeron bordered posteriorly, narrowly with black.

Wings hyaline, their attachments to the thorax ashy; other features as in male.

Abdomen: 1st segment pale brown with an incomplete apical, black ring; 2nd segment pale greenish yellow on dorsum, pale bluish green on sides at the apex and with a narrow, median, black mark on the dorsum; remaining segments a dirty yellow marked with a narrow, triangular, brown, median spot on dorsum of segments 3 to 7 and broad, apical and narrow, basal annules on segments 3 to 8; 9th segment brown at the base and sides only; 10th segment entirely yellowish green or pale yellow. Often the 8th segment is entirely black save for a small, apical spot which broadens laterally but does not meet its fellow over the dorsum.

Dentigerous plate rounded and covered with small denticules.

Anal appendages brown lanceolate, as long as the 2 last abdominal segments. Legs black.

Hab.—Throughout India in the montane and semi-montane areas, somewhat scarce in the North but becoming increasingly common as its distribution is traced southwards. The Western Ghats are its natural habitat, where it is found at any height above 2,000 ft. rarely being taken below that elevation. It breeds freely in all watercourses at Ootacamund and other hill-tops of the Nilgiris. I have taken it not uncommonly in the Poona District and found that it became more common as traced up to Satara and finally Mahabaleshwar at which latter place (in a restricted locality below the lake) it literally swarms.

Anax immaculifrons is one of our finest species both as regards its size and beauty. It is to be sought for in the beds of rocky mountain streams in which places it has a regular beat of a mile or more, plying restlessly backwards and forwards for hours. It oviposits in deep running water, inserting its eggs into the stems of reeds and whilst doing so is always guarded by the male which hovers above it at a height of 2 to 3 feet. The female engaged in this work will often be submerged almost up to its neck in the water. The larvæ are easily discernible crawling sluggishly along the mud at the bottom of mountain streams, and the exuviae may be found in such situations clinging to reed stems at the side of the streams.

2. *Anax guttatus*, Burm.

Brauer, Reise, d. Novara, Neur. p. 62 (1866); Hagen, Verh. Zool. Ges. Wien, xvii., p. 39 (1867); Martin, Coll. Zool. de Selys. Aeschnines (1909); Laidlaw, Ind. Mus. Rec. MS (1921).

Aeschna guttata, Burm. Handb. Ent. ii., p. 840. n. 14 (1839);

Anax magnus, Ramb. Ins. Nevr. p. 182 (1842); Brauer. l. c. p. 62 (1866).

Dr. Laidlaw has split up a number of forms of this insect into three series, A, B and C. Of these, series A is undoubtedly the true *Anax guttatus*, of Burmeister, and series B is most probably a local race of the same insect. Series C seems to approach the *parthenope* group and is doubtfully *Anax bacchus*, Hagen. Martin holds this view, as his description of the latter insect evidently tallies with that of Laidlaw's series C, and also with specimens of *Anax* which I have received from various parts of the Himalayas and had regarded as *A. bacchus*.

Male.—Abdomen 52 to 56 mm. Hindwing 49 to 52 mm.

Head: labium, labrum, epistome and frons pale yellow or olivaceous, unmarked; eyes sap green above and at the sides, pale yellowish green beneath; vesicle black; occiput black with a spot at its middle and the posterior border yellow.

In some specimens the labrum is bordered with brown; there is no T-shaped mark on the upper surface of the frons.

Prothorax brown, more or less concealed by the overhanging head.

Thorax bulky, sap green, without any markings. The tergum is in some specimens marked with brown.

Legs black, the femora reddish brown, especially the hinder pair.

Wings hyaline, slightly enfumed as a rule and the hinderpair marked broadly with a large, saffronated spot which extends from the outer end of the trigone as far as the 3rd postnodal nervure. This spot is not sharply defined but gradually diffuses near the median nervure in front and quite close to or even meeting the posterior border of the wing.

	7·17 17·9	9·20 19·9	9·16 16·9
Nodal index to wings :—	11·12 13·10	10·14 12·9	11·11 11·11

About 14 cells in the loop; hypertrigones traversed 3 to 4 times; 4 to 6 cells in the trigones; 4 to 5 cubital nervures.

Membrane moderately large, brown or grey and white or yellowish at the base; stigma greyish yellow bordered with dark brown, 5 to 6 mm. length.

Abdomen blackish brown with blue and orange or yellow markings as follows :—1st segment matt green on dorsum or buff coloured in some specimens and always so after death, the apex edged narrowly with dark brown; 2nd segment sky-blue above and at the sides but changing to white below and beneath, the dorsum with two, transverse, linear, black lines, the basal one of which is in the form of two scallops; 3rd segment with its basal half sky-blue, black spotted with orange at the apical half, the black area extending back in a cone-shaped manner into the blue and almost reaching the basal line of the segment; segments 4 to 8 blackish brown, each marked with a pair of small, basal spots of orange, a pair of long, oval, apical, orange spots and finally a pair of similar coloured spots in line with and between these two. On segment 7 and 8 and not infrequently on all segments, the two apical spots coalesce to form an irregular band, and occasionally all three spots are found to join up. On segment 8 the basal spot is very small or missing; segment 9 has a pair of triangular spots and 10 a pair of rounded, orange spots.

Anal superior appendages brown, 5 to 6 mm. in length or equal to the combined length of segments 9 and 10. Inferior appendages rather less than half the length of the superiors. (Fig. 3, i). The superior present a basal spine on the inner side and a flat, projecting ledge on the inner side; the apex is beveled outwardly and pointed. The inferior appendages are curved up at the apex and end in a blunt point.

The above description is made from a living specimen taken in Bombay and differs somewhat from the description of the type and from others taken further East and North. Dr. Laidlaw's description of his Series B is as follows :—

“Wings. Yellow tinge of hindwings less extensive, extends only as far as level of node. Basal white mark on membrane very small.

Head. A small triangular area in front of vertex is brown.

Abdomen. Black of dorsal surface is much more intense than in A (Type). The spots on the whole are smaller and do not coalesce and they are of a greenish yellow in colour. The basal spots on 7 and 8 are absent, the spot on 9 is small and that of 10 absent. There are no spots below the lateral, accessory carinae.

Anal appendages similar to Type. Female unknown.

Differs strongly in colour pattern from type and approaches Series C. In other respects it is not very different from A (Type).

Length of hindwing 54 mm., of abdomen 56 mm., of superior appendages 6 mm.”

I regard this variety as a local race or variety of *A. guttatus*.

Female—Very similar to the male but differing a little in shape and colour. The abdomen is more tumid and is not constricted at segment 3 as in the male. The whole abdomen tapers gradually from segment 2.

The eyes are pale green, the face and frons yellowish, the latter having a fine, basal, black line.

Abdomen. Segment 1 is reddish buff, segment 2 is only blue for quite a small area on the dorsum, its sides being silvery white. The ground colour is brown rather than black and the spots are larger, less defined and paler in colour and often coalesce.

Anal appendages lanceolate, with a stout mid-rib, brown.

Dentigerous plate rounded and coated with small denticules.

Hab.—Throughout India in the planes and submontane areas except in the dry zones. I have taken specimens in Madras, Ceylon, Bombay and Poona but have not seen it in the C. P. or Bangalore. It is most abundant in the area of country lying between the ghats and the sea on the Western side of India south of Mount Abu. Dr. Annandale has sent me specimens from Barkuda, Ganjam District, where he states that it is common. It may be seen hawking throughout the day along the borders of the Chilka Lake. I have seen the female ovipositing in quite small tanks in Poona and Bombay and have bred out larvæ obtained from a tank not more than 20 feet across. Clean, weedy tanks are the favourite spots to find them. The imago in Poona always emerged punctually at about 10-30 p.m., and the full colours had almost developed by dawn.

The species described by Dr. Laidlaw as Series C, from Assam and Bengal although closely allied to *A. guttatus* are I believe *A. bacchus* and are described as such below, hence I define the limits of true *guttatus* for the present as south of the montane areas of the *Himalayas*. Eastwards it extends into Burma and throughout the Straits and Indo-China.

3. *Anax parthenope*, "bacchus" Hagen. Verh. zool. bot. Ges. Wien, xvii., p. 34 (1867); Martin, Cat. Coll. Selys, fig. 16, Aeschnines, p. 85 (1909); Kirby, Cat. p. 85 (1890).

Anax guttatus, Series "C", Laid. Rec. Ind. Mus. (1921); Calv. Proc. Acad. Nat. Sci. Philad. pp. 148, 150 (1899).

Male.—Length of abdomen 50 mm., hindwing 48 mm.

Head: eyes in the living state bluish grey; face pale green; labrum and labium yellow, the former more or less bordered with black; vesicle yellow; frons pale green in front, yellowish green above and marked with a broad, black, T-shaped mark; occiput black (In specimens from Shillong and the Himalayas, the occiput is straight behind thus differing from *Anax guttatus* in which there is a minute point at the centre. In these specimens also, the colour is brownish black). (In a specimen which I have examined in the British Museum and which is labelled *A. bacchus*, the occiput is greenish yellow, the centre is raised into a pyriform bosse and the free border is laminated, cleft in the middle by a shallow notch, thus forming two laminated scallops. I think however that this specimen is a local race of *A. parthenope julius*.)

Prothorax brown, hidden almost entirely by the overhanging head. The thorax matt green, unmarked save for some occasional bluish spots on the tergum and the sutural lines which are obscurely blackish brown.

Legs black, the anterior femora yellowish at their bases.

Wings hyaline, the costa yellow outwardly, enfumed at the apices and diffusely along the termen as far as the 6th nervure (M3); membrane blackish brown or greyish black, its base not pale as in *guttatus*; stigma dark ochreous with

black borders, 5 mm. long; nodal index variable, $\frac{9 \cdot 16 \mid 16 \cdot 9 \quad 10 \cdot 17 \mid 19 \cdot 10}{11 \cdot 11 \mid 11 \cdot 11 \quad 12 \cdot 12 \mid 12 \cdot 11}$

trigones 4 to 6 cells, 4 to 5 cubital nervures; hypertrigones traversed 2 to 3 times.

Abdomen. Segment 1 matt green or pale brown, segment 2 sky-blue above and on the upper part of sides, the dorsum marked with a mid-dorsal line of black, connected with two transverse lines of the same colour.

Segment 3 bluish at its base, black for the apical half or two-thirds and with an apical and sometimes with a medial bluish spot on either side; segments 4 to 8 black spotted with bluish grey or dirty blue, varying in almost every specimen—usually however there is an oval, apical spot and a medial and basal small spot on each side which are never connected up; the 9th and 10th segments are black, the former with a single bluish spot and the latter either unspotted or with its apex and sides greenish yellow and the borders finely brown.

Anal superior appendages differ somewhat from those of *Anax guttatus*, they are decidedly broader, the middle third projecting markedly inward; the inferior appendage is square, greyish and with borders diffusely black.

Female very similar to the male and differing as follows:—

Eyes greenish grey in the living state; abdomen more tumid at the base and not constricted at the third segment as in the male. The blue on the 2nd segment is only evidenced by a small, diffuse area on the dorsum and the sides are silvery yellow; segment 3 has no trace of blue colouring and the base is greenish yellow.

The spots on the abdomen are greenish yellow in colour, larger and more extensive and there are additional basal, infero-lateral spots on segments 4 to 5 and sometimes also on 6.

Hab.—N. E. Himalayas, Assam, Upper Burma, Missouri and Dehra Dun. *Anax parthenope bacchus* appears to replace *Anax guttatus* in the North of India and bridges the gap between the latter species and *Anax parthenope julius*. It breeds in tanks and oviposits in shallow water.

4. *Anax parthenope julius*, Brauer.

Brauer, Verh. Zool. bot. Ges. Wien xvii (1865); Reise. d. Novara, Neur. pp. 61, 63 (1866); Selys, Odon. du Japon, C. R. Soc. Ent. Belg. xxvii. p. 116 (1883); Kirby Cat. Odon. p. 85 (1890).

Length of abdomen 58 mm, of hindwing 55 mm.

Male—Head; labium bright yellow; labrum the same colour bordered with black; face and front of frons greenish yellow unmarked save for a small, diffuse brown, transverse spot on lower part of frons where it joins the upper epistome; frons above finely bordered with black; behind which is a broad turquoise blue band. Posterior half of frons bright yellow marked centrally in front of vesicle by a projecting, subtriangular black spot. Eyes opalescent; occiput yellow, posterior border a little concave with the concavity bridged across by a thin lamina.

Prothorax yellowish.

Thorax matt green, the alar sinus and the tergum blue, the former finely outlined in black.

Legs black, femora reddish for their basal two-thirds; coxæ yellow margined with black at their junction with the synthorax.

Wings hyaline, not enfumed or saffronated in any part; costa yellow as far as the stigma which is ochreous on its upper surface and yellowish beneath and bordered with black, 6 mm. in length; membrane black, its basal third white; trigones with 6 ceus in the forewing, 4 in the hind; cubital nervures

5 in forewing; 4 in the hind; nodal index :— $\frac{10 \cdot 17}{11 \cdot 12} \mid \frac{19 \cdot 10}{12 \cdot 11}$; 14 to 15 cells in

the loop.

Abdomen tumid at the base, constricted at the 3rd segment and of even width thereafter as far as the end; segment 1 yellowish green finely bordered basally with black, two irregular, diffuse, small, brownish spots on each side, one subdorsal, the other nearly ventral; segment 2 turquoise blue, the dorsum very finely, the base and two transverse, fine lines black; segments 3 to 8 pale dirty blue, the dorsum of all segments rather broadly black, this colour

prolonged outwardly and finely along all transverse sutures and at the junction of the apical and middle thirds, as a short angular projection. The supplementary ridges and the apical halves of the segments 3 to 6 below these ridges are also black, whilst on segments 7 to 10 the part below the lateral ridges is entirely black; the 9th and 10th segments are broadly black on the dorsum and finely along the lateral and posterior borders.

Superior anal appendages 5 mm. long, dark brown, very similar to *guttatus* but more abruptly narrowed after the middle third. The inferior appendage is barely one-third the length of the superior, quadrate, the end turned up slightly and presenting two teeth at either angle when viewed in profile, pale brown but darker at the borders (Fig. 3, 2).

Female very similar to the male but the abdomen more tumid at the base and not constricted at the third segment. There is only a slight trace of turquoise blue on the dorsum of the 2nd segment and none on that of the 3rd, the sides of these two segments are silvery white.

The markings are almost identical with those of the male on the rest of the segments, but the black is more extensive and tends to cut up the marginal dull blue into spots which however are always coalescent to some extent. The thorax is pale brown or fawny.

Dentigerous plate subdenticate and rounded.

Anal appendages lanceolate and with a stout mid-rib.

Hab.—Himalayas, Bengal and Assam. The specimens described above are from Darjeeling District. Eastwards it spreads into China and Japan.

Anax julius bridges the gap between *Anax tacchus* and *parthenope*, both of which it resembles somewhat, the colouring of the frons will however suffice to differentiate them.

5. *Anax parthenope parthenope*, Selys, Bull. Acad. Belg. vi. (2) p. 389 (1859); id. Mon. Lib. Eur. p. 119 (1840); id. Rev. Odon. p. 111 (1850); Brauer Reise d. Novara, Neur. p. 61 (1866); Hagen, Neur. N. Amer. p. (1867); Kirby, Cat. Odon. p. 85 (1890); Laid Rec. Ind. Mus. MS (1921). Calvert, Proc. Acad. Nat. Sci. Philad. (1898), pp. 148-149, fig. 3 A. t.; Martin, Cat. Coll. Selys, Aeschnines, xix, xx, p. 20 (fig. 15) (1909).

Aeschna parthenope, Selys, loc. cit.

Aeschna parisinu, Ramb. Neurop. p. 185, t. I. f. 10 (1842).

Length of abdomen, male 53 mm, female 50 mm, hindwing 49 to 50 mm.

Male—Head: labium, labrum and face as well as front of frons cinereous, whitish or very pale yellow; upper surface of frons marked anteriorly with a broad, blackish brown, transverse band, posterior to which is a narrow line of pale brown followed again by a band of pale blue. Base of frons bluish with a very small, black triangle in the suture in front of vesicle; the latter black in front, pale yellow or whitish yellow above; occiput bright yellow behind but with a small, black, triangular area in front.

Prothorax pale brown, almost entirely obscured by the overlapping head.

Thorax pale brown or greyish or faintly tinted with greenish yellow. In Basra specimens the colour is a pale slate blue and the only markings are the sutures which are finely outlined in black.

Legs black, the middle and posterior pairs of femora reddish, the anterior pair black outwardly, pale whitish yellow inwardly. The middle and posterior femora with a row of very closely-set, very small even spines, the distal few slightly more robust.

Wings hyaline or partially enfumed, often quite deeply so. In one specimen from Basra the extreme tips of the wings are enfumed and the outer two-thirds, from the outer end of the trigone to rather beyond the stigma is a smoky amber tint; in other specimens the wings have a deeply enfumed, brownish area

beginning diffusely from distal to or proximal to the node and ending rather abruptly at the level of the outer end of stigma. This fascia is very noticeable when the insect is flying and is always much more extensive in the females. If present in the males it is usually more amber tinted. Stigma pale brown above, whitish yellow beneath, 4.0 to 5.5 mm. in length and larger in the female; membrane white; trigones with 4 to 6 cells in the forewing, 3 to 4 in the hind;

eubital nervures 4 in all wings; nodal index:— $\frac{7 \cdot 15}{9 \cdot 11} | \frac{16 \cdot 8}{10 \cdot 9} \quad \frac{8 \cdot 14}{11 \cdot 12} | \frac{14 \cdot 8}{11 \cdot 10}$
 $\frac{11 \cdot 18}{11 \cdot 11} | \frac{17 \cdot 11}{11 \cdot 12} \quad \frac{8 \cdot 15}{10 \cdot 10} | \frac{15 \cdot 8}{10 \cdot 9}$; 13 to 14 cells in the loop.

Abdomen tumid at the base, well constricted at the 3rd segment and very gradually enlarging thereafter as far as the anal end. 1st segment pale buff, darker brown on the dorsum and with a pruinulent, dark round spot on the side; 2nd segment pale turquoise blue, marked with a fine apical and a basal black ring. There is also a small transverse, linear, black mark on either side of the dorsum, distal to the middle of the segment. The dorsum more or less spiny and black, this colour usually limited to the minute spines. A black spot on the side represents the rudimentary auricle; 3rd segment turquoise blue for rather more than its basal half, white low down on the sides and brownish black for the apical third or more and here marked with three conjoined, dirty blue, elongate spots, somewhat irregular in shape, the brown on the dorsum spreads basalwards into the blue almost up to the base of the segment; segments 4 to 8 blackish brown on the dorsum, pale blue at the sides, the dark dorsal colouring invading it along the transverse sutures and by a triangular point near the apex, the supplementary ridges are finely brown, as is also the apical area beneath them; segment 9 is broadly black on the dorsum and blue at the sides, its lateral borders finely black; 10 is brownish black with the sides and apical border yellowish.

Anal superior appendages nearly as long as the 9th and 10th segments taken together, dark brown, the apices paler inwardly. Evenly convex on the inner side for the basal three-fourths and the apex rather abruptly narrowed and with a small point on the outer side.

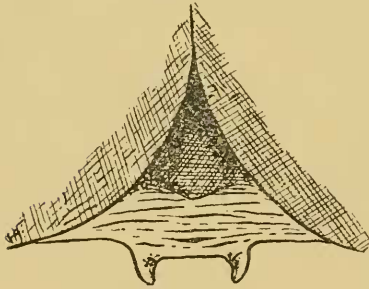


FIG. 4.
Occiput of *Anax parthenope*
parthenope, female.

Inferior appendage white with brown borders, less than one-fourth the length of the superiors, its apical border with numerous fine spines directed upward (FIG. 3, 4).

Female very similar to the male but with a stouter abdomen and no constriction of the 3rd segment. Differs as follows:—Labrum bordered with brown; frons in front has a narrow, reddish brown bordering, above a bordering of dull blue and the base pale blue. There is no basal, black, triangular spot. Occiput very highly specialized, shiny black in front, bright yellow posteriorly, the posterior border projects backward slightly as a quadrate lobe furnished with a small horn at either angle. (fig. 4). The blue on abdominal segments 2 and 3 is restricted to but a small area on the dorsum and the sides of these segments are silvery white. The 10th segment is entirely yellow save for a small, black, dorsal mark at the base.

Anal appendages brown, lanceolate, rapidly tapering to a point, with a strong mid-rib running throughout their length. Dentigerous plate rounded, its posterior border straight and its surface coated with minute denticules.

Hab.—Mesopotamia, India throughout the Deccan, Rajputana and Sind. I have found it breeding in small tanks in Poona. Elsewhere it is found throughout the Mediterranean, and Asia Minor and the Near East.

GENUS HEMIANAX, Burm.

HEMIANAX, Selys, Bull. Acad. Belg. (3) v. p. 723 (1883); Kirby, Cat. Odon. p. 85 (1890); Martin, Cat. Coll. Selys, Aeschnines, xix, xx; p. 80 (1909); Tillyard, J. L. Soc. Lond. Zool. xxxiii, July (1916), Laid. Rec. Ind. Mus. MS. (1921).

Cyrtosoma, Selys, Trans. Ent. Soc. Lond. p. 412 (1871).

Aeschna, Van der Lind.

Very similar to genus *Anax* but generally smaller and with shorter abdomen. The latter has no supplementary ridges on the sides of segments 4 to 8 and is therefore smooth and cylindrical.

The superior anal appendages are sublanceolate in the male and taper more rapidly than in *Anax*, in the female they are typically lanceolate. Inferior anal appendages subtriangular and with the lateral borders furnished with robust imbricated spines. (Selys aptly described this appendages as resembling the lower jaw of a python with its imbricated teeth.)

Wings similar to genus *Anax*.

7. *Hemianax ephippiger*—Burmeister, (*Aeschna ephippiger*), Handbk. Ent. ii. p. 840. n. 15 (1839).

Anax ephippiger, Brauer, Reise. d. Novara, Neur. p. 63 (1866); Hagen, Verh. Zool. bot. Ges. Wien, xvii, p. 21 (1867).

Aeschna mediterranea, Selys, Bull. Acad. Belg. vi. (2) p. 391 (1839).

Anax mediterranea, Selys, Mon. Lib. Eur. p. 120 (1840).

Anax mediterraneus, Selys, Rev. Odon. p. 329 (1850); Brauer, loc. cit. p. 63 (1866).

Anax senegalensis, Ramb. Ins. Nevr. p. 190 (1842).

Length of abdomen 45 to 48 mm, of hindwing 45 to 46 mm.

Male—Head: eyes sage green above changing to yellow beneath; labium bright yellow; labrum and face greenish yellow; frons bright yellow, its anterior border and front blackish brown, its base very narrowly black before the eyes and vesicle; vesicle yellow with a blackish base; occiput greenish yellow, slightly concave behind and raised in a medial ridge in continuation of the ophthalmic suture. Eyes behind black and marked with bright yellow.

Prothorax yellowish.

Thorax pale ochreous brown or sage green on the dorsum, greenish yellow on the sides, the metepimeron sometimes a bluish green. No markings save for a fine black belt bordering the coxæ.

Legs black, base of hind femora reddish brown, anterior femora bright yellow behind, and within, black in front. Hind femora with a row of closely-set, gradually lengthening, but short spines.

Wings hyaline but with a diffuse saffronated spot in the hindwing very similar to that seen in *guttatus* extending from the trigone to well beyond the node. Much smaller and often entirely absent in the male. In addition there is some slight saffronation of the bases of the wings, especially in the female; membrane white, its anterior margin narrowly black throughout its length; stigma 5 to 5.5 mm in length, bright ochreous margined posteriorly with dark brown; reticulation black and yellow, the costa yellow as far as apex; trigone of forewing with 5 cells, 4 in the hind, narrower than in *Anax*; 5 cubital nervures in the forewing, 4 in the hind; 10 to 14 cells in the loop.

Nodal index—Male:— $\frac{8 \cdot 15 | 16 \cdot 7}{9 \cdot 10 | 11 \cdot 9}$, Female $\frac{7 \cdot 14 | 15 \cdot 7}{10 \cdot 11 | 11 \cdot 10}$, $\frac{7 \cdot 16 | 16 \cdot 7}{10 \cdot 10 | 10 \cdot 10}$

Abdomen tumid at the base, a little constricted at the 3rd segment and from thence of even width as far as the anal end, the 9th and 10th being slightly broadened. Cylindrical and smooth due to the absence of the supplementary ridges on the sides. Ground colour ochreous on the dorsum changing to olivaceous or greenish yellow on the sides and beneath. 1st segment brown on the dorsum, this colour extending out as a transverse median line and also along the apical margin. Space between the 1st and 2nd segments greenish yellow. The dorsum of the 2nd segment turquoise blue, its apex finely and base rather more broadly black or dark brown, its sides silvery white; the dorsum of segments 3 to 7 irregularly and narrowly brownish black and with a small, lateral, diffuse brownish spot at the lower part of the apical half; on 8 and 9 this spot extends basalwards and joins up with the black of dorsum which is much more extensive on these two segments, and thus encloses a large spot of the ground colour, on segment 8 there is also a smaller spot enclosed at the base; 10th segment has a single, large apical spot on each side, connected across the dorsum apically with each other.

Anal superior appendages as long as the 9th and 10th segments taken together lanceolate, tapered to a fine point, strongly keeled, the keel raised into a robust, spinous process near the apex of the appendix, very prominent when viewed from the side, reddish brown. Inferior appendage not half the length of the superior, yellow stippled with black bordered laterally above with several, robust imbricated, black spines.

Female very similar to the male but differing as follows:—

The occiput instead of being concave behind, projects back slightly in the form of a fine lamina the edge of which curls slightly up. Above it is raised into a pyriform, shiny boss, the broad, rounded end of which is sharply marked off from the laminated, posterior portion.

The abdomen is more tumid, the 3rd segment not constricted but tapering gradually to the anal end; the 2nd segment has only a small spot of turquoise blue on its anterior third; the sides of the 3rd segment more broadly white; the black markings less extensive on segments 3 to 7.

The anal appendages more typically lanceolate and with a strong keel running throughout their length and not raised in a tubercle or spine near the apex. Dentigerous plate very similar to that of *Anax parthenope parthenope*, rounded and subdentate.

Hab.—Mesopotamia, Persia, North Africa, India throughout the plains and dry areas, more especially Sind, Gujerat, Rajputana and parts of the Deccan. This species is given to long migrant flights, often swarming in great numbers. I saw one such on the 20th November 1919 when at sea, some 40 miles off the Kathiawar Coast. All the specimens taken on board the ship were fresh, and some quite teneral. In Mesopotamia it breeds in irrigation canals and marshes, whilst in India I have found it breeding in small tanks. It is interesting to note that a close observer like De Selys when describing this species (under the name of *Anax mediterraneus*) quite overlooked the absence of the supplementary ridges on the abdomen which are so serviceable for identifying the insect.

(To be continued.)